

Senior High School Students' Perceptions of Mathematics Teachers' Assessment Practices in Ghana

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This study examines mathematics teachers' assessment practices for senior high school students in Ghana. Formative assessment has been identified in the literature as having a significant impact on students' learning. However, less attention has been given to students' perceptions of teachers' assessment practices in Ghana. Data involved questionnaires for 420 senior high school students and 308 senior high school teachers in the Ashanti Region of Ghana. The results showed that students and teachers hold different perceptions of assessment practices, and suggest teachers should pay more attention to questions, homework, student observation, student demonstration and group work to support students' progress and better examination attainment.

Introduction

This study examines mathematics teachers' assessment practices for senior high school students in Ghana. Classroom assessment is a component of all teacher's activities which should serve as the basis for the decisions made about students' learning in the classroom (Moss & Brookhart, 2019). Teachers have a professional responsibility to assess students' learning progress. Recent research suggests that teachers should regularly review and check students' progress to ensure that students achieve planned learning outcomes (Birenbaum et al., 2015; Klenowski, 2009). Some teachers focus more on the end of term assessment (summative assessment) rather than checking students' learning regularly and throughout the students' learning experiences (formative assessment) (Andersson & Palm, 2017). Summative assessment is a judgement to determine students' overall performance in a program (Moss & Brookhart, 2019) and is commonly referred to as assessment of learning. In Ghana, the annual examination conducted by the West African Examination Council for students at the end of their third year of senior high school education is an example of high-stakes summative assessment (Okyere & Larbi, 2019). The purpose of this assessment is for certification and selection into tertiary institutions (Dogbey & Dogbey, 2018). Summative assessment provides less support for student learning because its emphasis is on achievement at the end of the program (Kippers et al., 2018). In contrast, formative assessment is the process by which teachers use assessment practices to elicit information throughout a learning program so teaching and learning can be adjusted to improve students' outcomes (Popham, 2009). This is also known as assessment for learning (Black & Wiliam, 1998; Moss & Brookhart, 2019).

Assessment for learning helps teachers to identify gaps in students' learning (Kippers et al., 2018), to monitor students' progress (Moss & Brookhart, 2019), and to enhance students' performance through feedback. Researchers are of the view that assessment for learning methods that focus on day-to-day progress enable students to think creatively and develop their analytical skills (Thompson & Goe, 2009). Assessment for learning practices include observation, questioning, homework, group work, portfolios, self-assessment, peer assessment, student demonstration, student observation, classroom discussion and quizzes (Moss & Brookhart, 2019). These instructional practices necessitate students' involvement in the formative assessment process, and allow teachers to identify specific student errors, and provide feedback to help correct these errors (McMillan et al., 2013).

The assessment paradigm has shifted from the assessment of learning to assessment for learning. Formative assessment has been strongly advocated by organizations such as the World Bank (2013) and the Assessment Reform Group (2002). The World Bank "links high

quality, formative assessment to better outcomes on standardised tests, and links better learning outcomes to increased national prosperity” and “directly links improvements in reading and mathematics to increased GDP” (Browne, 2016, p. 4). Many developed countries such as Australia, Canada, England, Singapore and USA have already embedded formative assessment into their education systems (Organisation for Economic Co-operation and Development, 2005). This has shifted the attention of Sub-Saharan African countries such as South Africa, Malawi, Uganda, Ghana, Nigeria and Ethiopia to practice formative assessment in their education systems (Browne, 2016).

Ghana has a “vision … to transform its economy and society into a stable, united, and prosperous country with opportunities for all” (Government of Ghana, 2014), to increase the average national income. A major driver of this vision is seen to be in the transformation of educational practices. Ghana’s pre-tertiary framework (2018), developed for basic and senior high schools, has a focus on mathematics and science as the fundamental building blocks for success in the era of technological advancement in Science, Technology, Engineering and Mathematics (STEM) subjects. This framework also recommends that schools should “shift from an emphasis on summative assessment to the formative, a philosophy that espouses the need to employ multiple sources of evidence about learning, which will guide instructional decisions and support each learner’s learning trajectory” (p. 19).

Despite these recommendations, there is little use of Assessment for Learning (AfL) in Ghanaian schools which is believed to be due to lack of experience and knowledge by teachers, and also limited availability of resources for teachers to use. The syllabi give detailed information on what the students learn, but no information on tools and approaches teachers can use, scoring criteria rubrics and suitable assessment tasks for AfL (Ghana’s pre-tertiary curriculum framework, 2018, p. 11).

There have been many studies conducted on the assessment for learning practices of teachers in Ghana and elsewhere (e.g., Amoako et al., 2019; Amua-Sekyi, 2016; Martínez et al., 2009; Pat-El et al., 2015; Yan & Cheng, 2015), but there are fewer studies that include students’ perspectives even though the students’ perceptions can play a vital role in the choice of assessment practices of the teachers (Drew, 2001; Struyven et al., 2005). MacLellan’s (2001) study of tutors and students’ perceptions of assessment for learning in a higher education context showed that whereas the tutors perceived their assessment as formative, the students perceived their assessment to be mainly summative. With these factors in mind, the research questions for this study were.

- RQ1. What assessment practices do senior high school mathematics teachers use to assess senior high school students’ learning?*
- RQ2. What assessment practices do senior high school mathematics students report their teachers use to assess their learning?*
- RQ3. To what extent do senior high school students perceive these practices are helpful in their learning and their examination attainment?*

Teachers’ Assessment Practices

Internationally, teachers use a variety of different practices to gather information about students’ ongoing learning in the classroom (e.g., Kippers et al., 2018; Okyere & Larbi, 2019; Wiliam et al., 2004). Kippers et al. (2018) investigated AfL classroom assessments in the Dutch education system and found that the most frequently used assessment practices were paper-and-pencil exercises, asking questions, classroom observations, and homework assignments. Other less often used assessment practices included digital tests, oral tests, portfolios, practical tasks, presentations, and questionnaires. Wiliam et al. (2004) studied the use of AfL practices of secondary mathematics teachers and found that they used questioning, feedback, sharing

criteria with learners, self-assessment, posters and presentations. A study of formative assessment practices of teachers in Ghana (Asare, 2015; Bekoe et al., 2013) showed that teachers used varied assessment practices. For example, Bekoe et al. (2013) examined the formative assessment practices tutors used to assess pre-service teachers' learning in Social Studies in three Colleges of Education in Central Region of Ghana. The findings indicated that diagnostic assessment, portfolio assessment, self-assessment and peer assessment were the major formative assessment practices used in the Colleges of Education in Ghana. Also, Asare (2015) investigated kindergarten teachers' classroom formative assessment practices based on two subscales: (a) teachers' modes of assessment frequently used, and (b) their reasons for selecting a particular mode of assessment. The results of the study indicated that paper- and pencil test, standardized test, interviewing, observation portfolios and performance task were the formative assessment practices used by teachers to assess kindergarten pupils. However, Okyere and Larbi's (2019) research of mathematics teachers' assessment practices revealed that the assessment practices used by these teachers included written tests, quizzes, classroom discussions, teacher questioning, answering responding to questions from students, observations, student journal writing, classroom discussion, student demonstration and role play/presentation.

Students' Perceptions of Teachers' Assessment Practices

Teachers' use of assessment practices to support students' learning requires students' participation (Cachia et al., 2018). However, as noted earlier, students and teachers may have different perceptions of teachers' assessment practices (Crook et al., 2006). For example, Gao (2012) examined 248 American high school students' perceptions of mathematics classroom assessment. The study found that the students perceived the tasks as less authentic (featuring real-life situations) and less transparent (student knowledge of the purpose of the assessment) than the teachers believed they were providing. Dhindsa et al. (2007) evaluated 1,028 upper secondary science student perceptions of their assessments. Whereas the students perceived that their assessment matched what they had covered in class, they also thought that there was little connection between their assessment tasks and what they used in daily life. A study of high school students and teachers in the Netherlands also found that the teachers perceived they were using a higher level of AfL than the students (Pat-El et al., 2015).

Iannone and Simpson (2013) investigated undergraduate mathematics students' perceptions of which assessment methods are better discriminators of mathematical ability. Forty-eight undergraduate students took part in this research. The assessment practices used were multiple choice tests, closed-book exams, oral exams, presentations, example sheets, dissertations, open-book exams and projects. The findings of the study showed that while closed-book examinations are a common practice of teachers, the undergraduate students perceived they inhibited their mathematical ability. This demonstrates how students can have different perceptions of assessment from their teachers.

Methods

Study Participants

A total of 728 students and teachers participated in the study, of which 420 were senior high school students and 308 were senior high school mathematics teachers. Both teachers and students were purposively recruited from 20 public schools in six districts in the Ashanti region of Ghana. The researcher contacted the principals of the various senior high schools who facilitated the researcher's access to the assistant academic principals, heads of mathematics departments and the mathematics teachers in the selected schools. In consultation with the

heads of the mathematics departments, the mathematics teachers selected the students from different programmes offered by the schools and invited them to participate.

Instruments

Two sets of questionnaires, one for teachers, and one for the students, were developed based on the gaps and emerging themes identified in the literature. Both teachers' and students' questionnaires were adapted from instruments previously developed by Lysaght and O'Leary (2013), and Pat-El et al. (2013), both with large cohorts. The questionnaires were piloted with a smaller sample of students and experienced senior mathematics teachers in selected schools before administering to the wider study participants.

The teachers' questionnaire included both open-ended and closed-ended questions categorized into two sections of 33 items in total. The open-ended questions in the first section (Part A) gathered teachers' demographic information with seven items in respect of gender, age, academic qualifications, category of the school, teaching experience and professional qualification. The second section (Part B) comprised 26 items on the frequency of teachers' given assessment practices for formative and summative purposes (See Table 1). The students' questionnaire was in three sections. Section A gathered participants' demographic data in respect of gender, age, the course offered, category of school and year level in the school. Section B (13 items) sought students' perceptions about teachers' frequency of use of the listed assessment practices (See Table 2). These items were measured on a five-point Likert scale, ranging from *seldom used* to *used very often*. Section C sought students' perceptions of how these teachers' assessment practices supported their learning and better examination attainment (See Table 3). These 13 items were measured on a 5-point Likert scale ranging from *not at all helpful* to *extremely helpful*.

Both teachers' and students' questionnaires were administered personally by the first author at the same time in all the selected schools, during the COVID-19 pandemic period, with attention to COVID-19 protocols. Both questionnaires were in the English language as this is the medium of instruction used in senior high schools in Ghana.

Reliability of the questionnaires was initially checked using the results of the pilot test with fifty students and ten teachers in a senior high school that was not part of main study. calculated Cronbach's alpha was calculated to check the internal consistency of the instruments (DeVellis, 2012), with both teachers' assessment practices and students' perception of teachers' assessment practices showing high correlations for reliability (0.89 and 0.87 respectively) for the whole study. Out of the 520 questionnaires distributed to senior high school students, 420 were returned, representing a response rate of 82.6% for the data analysis. For the teachers, out of the 400 questionnaires, 308 were returned representing a 77 % response rate for the data analysis.

Ethical Considerations

The wider study from which this paper is drawn received institutional approval from the University of Tasmania Social Sciences Human Resources Ethics Committee, and the selected Districts and Municipalities Directors of Education in Ghana, before the data collection.

Data Analysis

The data were entered and analysed using the Statistical Package for the Social Sciences (SPSS), Version 27. The quantitative data gathered from the questionnaire of both teachers and students were analysed using descriptive statistics such as means and standard deviations. Because of the large sample size, it was assumed that the data were normally distributed (Field, 2013).

Results

In addressing RQ1, the mean and standard deviation of the frequency of mathematics teachers' formative and summative assessment practices were calculated. The means and standard deviations of the respondents' responses are summarized as follows in Table 1. From this table it is observed that the most frequently used forms of formative and summative assessments were questioning, traditional assessment such as multiple-choice tests, and classroom discussion. It was observed that the least practised formative and summative assessment strategies were peer-assessment, student demonstration and portfolios.

Table 1
Teachers' Reported Use of Various Forms of Assessment. Higher Means Reflect Higher Use.

No.	Assessment Practices	Mean	Standard Deviation
1	Questions	4.42	0.74
2	Traditional Assessment (e.g., multiple choice, true-false, and short answers)	4.08	1.15
3	Students Observation	3.86	0.83
4	Classroom Discussion	3.77	1.25
5	Quizzes	3.62	0.91
6	Paper and Pencil Test	3.51	1.21
7	Role play/Presentation	3.37	1.36
8	Self -Assessment	3.29	1.04
9	Group work	3.28	1.81
10	Homework/Assignment	3.03	1.12
11	Peer Assessment	3.03	1.12
12	Student demonstration	2.82	1.36
13	Portfolios	2.78	1.18

In addressing RQ2, the mean and standard deviation were calculated for how the students perceived the frequency of their teachers' assessment practices, and these are summarised in Table 2. The most dominant formative and summative strategies that students saw used by teachers were questioning and homework/assignments. The students perceived that portfolios, student demonstration and peer assessment were used least often. Table 3 shows the means and standard deviations students' perceptions of the helpfulness of the formative assessment used by their mathematics teachers in their learning and attributed success in examinations. According to the students, the most helpful formative strategies identified by students were questions and homework/assignments. The least helpful was role play/presentation.

Table 2
Students' Perception of Teachers Use of Assessment Practices. Higher Means Reflect Higher Use.

No.	Assessment Practices	Mean	Standard Deviation
1	Questions	4.32	.94
2	Homework/Assignment	3.88	1.16
3	Classroom Discussion	3.77	1.25
4	Student Observation	3.67	1.24
5	Role play/Presentation	3.37	1.36
6	Paper and Pencil Test	3.34	1.31
7	Traditional Assessment (e.g., multiple choice, true-false, and short answers)	3.30	1.34
8	Self -Assessment	3.24	1.42
9	Quizzes	3.14	1.26
10	Group Work	3.03	1.33
11	Peer Assessment	2.98	1.33
12	Student Demonstration	2.82	1.36
13	Portfolios	2.53	1.31

Table 3
Showing the Mean and Standard Deviation of Students' Perceptions of the Helpfulness of the Assessment Practices for Learning and Better Examination Attainment

No.	Assessment Practices	Mean	Standard Deviation
1	Questions	4.31	0.97
2	Homework/Assignment	4.10	1.05
3	Students Observation	4.06	1.04
4	Student Demonstration	4.04	1.06
5	Group Work	4.01	1.07
6	Paper and Pencil Test	3.93	1.06
7	Peer Assessment	3.91	1.11
8	Quizzes	3.90	1.09
9	Traditional Assessment (e.g., multiple choice, true-false and short answers)	3.89	1.14
10	Self- Assessment	3.78	1.11
11	Portfolios	3.71	1.08
12	Classroom Discussion	3.62	1.26
13	Role play/Presentation	3.31	1.22

Discussion

The results of this research showed that Ghanaian teachers used varied assessment practices to monitor student's progress and improve learning performance, of a mixed formative and

summative nature. The students and teachers both perceived that questions, student observations and classroom discussion were used frequently. However, the students perceived homework (second in frequency) as used more often than the teachers did (tenth in frequency). They also perceived traditional assessment to be used less often than the teachers did. These teacher findings are similar to the study by Kippers et al. (2018) who found that the teachers most often used paper-and-pencil tests, questioning, classroom conversations and homework assignments. These are, however, very different from the findings of Wiliam et al. (2004) who found that the teachers used feedback, sharing the criteria with students, and self-assessment more frequently than these teachers in Ghana. This may be owing to a combination of large class sizes in Ghana and a lack of knowledge of AfL practices by the teachers in Ghana (Amoako et al., 2019; Amua-Sekyi, 2016).

When it came to how the students regarded the helpfulness of the different assessment practices for their learning and examination attainment, the students listed questions first, followed by homework, then student observations, student demonstrations and classroom discussion. However, on the teachers' list in terms of frequency, question was first, homework was tenth, student observation was third, student demonstration was twelve and class discussion was fourth. This implied that questions, student observation and classroom discussion were perceived by both teachers and students as the most helpful practices of teachers' assessment practices to support learning and better examination practices. However, homework and student demonstration which were perceived by students as very helpful were not frequently used by teachers. This adds new knowledge to existing literature which suggests that mathematics teachers should pay attention to homework and student demonstration which are perceived by students as very helpful to support learning and better examination attainment. Further, this research adds new knowledge to existing literature where students' perception of teachers' assessment practices is less studied in the developing countries. It was noted earlier that whereas the Ghanaian Ministry of Education recommends a shift in emphasis from summative to formative assessment, Ghanaian teachers do not have an extensive knowledge of these practices and there are few resources available for them to develop these practices. This research illustrates that students do not perceive that their teachers use formative assessment practices such as self-assessment, peer-assessment and portfolios, even though the students believe these to be helpful to them. This knowledge may assist in motivating teachers to learn more about, and more widely apply, assessment for learning practices.

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